

## **REMARKS/ARGUMENTS**

### **STATUS OF CLAIMS**

Claims 1, 2, 6-19, 21-23, 26, 29, 30, 34-38, 41 and 42 are currently pending in this patent application. By the Amendment, claims 7, 9-11, 13-16, 18, 36, and 37 are amended, leaving claims 1, 2, 6, 8, 12, 17, 19, 21-23, 26, 29, 30, 34, 35, 38, 41, and 42 unchanged. Claims 3-5, 20, 24, 25, 27, 28, 31-33, 39, and 40 were previously canceled in response to a Restriction Requirement. The Applicants appreciate the Examiner's allowance of claims 29, 30, 35, and 38 indicated on page 5 of the Office Action.

### **CLAIM REJECTIONS – 35 U.S.C. § 112**

On pages 2-3 of the Office Action, claims 9-11, 13-16, 18, 36, and 37 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicants regard as the invention. Claims 9-11, 13-16, 18, 36, and 37 are hereby amended to address the Examiner's objections. Accordingly, the Applicants hereby respectfully submit that these amended claims meet the requirements of 35 U.S.C. §112. Withdrawal of the 35 U.S.C. §112 rejections of claims 9-11, 13-16, 18, 36, and 37 are therefore respectfully requested.

### **CLAIM REJECTIONS – 35 U.S.C. §102**

On page 3 of the Office Action, claims 19, 21, and 26 are rejected under 35 U.S.C. §102(b) as being anticipated by Fries (U.S. Patent No. 4,108,239).

Claim 19 calls for:

A wick for a heat pipe comprising:  
a plurality of particles comprising a first diameter and a second diameter,  
said plurality of particles being joined together so as to form a network of  
capillary passageways between said particles; wherein said first diameter  
particles are disposed within a first substantially homogenous layer and said  
second diameter particles are disposed within a second substantially homogenous  
layer.

Claim 21 calls for:

A heat pipe comprising:  
a sealed enclosure having an interior surface;  
a working fluid disposed within said enclosure; and  
a wicking structure disposed upon said interior surface and comprising a plurality of particles including a first species of particle and a second species of particle, said plurality of particles being joined together so as to form a network of capillary passageways between said particles; wherein said first species of particle and said second species of particle are each disposed within said wicking structure in substantially homogenous layers.

Claim 26 calls for:

A heat pipe comprising:  
a hermetically sealed and partially evacuated enclosure, said enclosure comprising internal surfaces;  
a wick disposed on at least one of said internal surfaces and comprising a plurality of particles comprising a first species of particle having a first size and a second species of particle having a second size, said plurality of particles being joined together so as to form a network of capillary passageways between said particles; wherein said first species of particle and said second species of particle are each disposed within said wick in substantially homogenous layers; and  
a two-phase fluid at least partially disposed within a portion of said wick.

In contrast, Fries discloses a heat pipe having a wick that comprises a first layer having a small-pore structure and disposed adjacent a vapor space within a pipe, and a second layer having a large-pore structure and disposed adjacent the first layer (*Abstract*). The Applicants respectfully submit that *pore size* as disclosed by Fries (in the context of a wick structure for a heat pipe) is not necessarily indicative of *particle size* within a wick structure. By way of example only, a layered wick defining different pore sizes in different locations of the wick can be created using a uniform particle size throughout the wick, such as by a lost material process or in other manners. Fries is completely silent regarding how the different pore sizes disclosed in Fries is defined, and fails to teach, describe, or suggest that the large and small pores are created using particles having different sizes. Accordingly, Fries fails to teach, describe, or suggest, among other things, a heat pipe or wick for a heat pipe comprising a plurality of particles including a first [diameter, species, or size] of particle and a second [diameter, species, or size] of particle, wherein the plurality of particles is joined together so as to form a network of

capillary passageways between said particles; and wherein said first [diameter, species, or size] of particle and said second [diameter, species, or size] of particle are each disposed within said wicking structure in substantially homogenous layers” as claimed in claims 19, 21, and 26.

In light of the above and for other reasons not discussed herein, withdrawal of the 35 U.S.C. §102(b) rejections of claims 19, 21, and 26 is respectfully requested.

### CLAIM REJECTIONS – 35 U.S.C. §103

#### Independent Claims

On page 4 of the Office Action, claim 34 is rejected under 35 U.S.C. §103(a) as being unpatentable over Fries in view of Corman et al. (U.S. Patent No. 3,828,849).

Claim 34 calls for:

A heat pipe comprising:  
a hermetically sealed and partially evacuated enclosure, said enclosure comprising internal surfaces;  
a wick disposed on at least one of said internal surfaces and comprising a plurality of particles comprising a first species of particle having a first size and a second species of particle having a second size, said plurality of particles being joined together so as to form a network of capillary passageways between said particles; wherein said first species of particle and said second species of particle are each disposed within said wick in graded homogenous layers, and further wherein at least one vapor vent is defined through said wick; and  
a two-phase fluid at least partially disposed within a portion of said wick.

In contrast, and as described above, Fries discloses a heat pipe having a wick that comprises a first layer having a small-pore structure and disposed adjacent a vapor space within a pipe, and a second layer having a large-pore structure and disposed adjacent the first layer (*Abstract*). Thus, Fries fails to teach, describe, or suggest, among other things, a heat pipe comprising “a wick...comprising a plurality of particles comprising a first species of particle having a first size and a second species of particle having a second size...said first species of particle and said second species of particle are each disposed within said wick in graded homogenous layers” as claimed in claim 34.

Corman et al. disclose a heat pipe with a portion of a wick having a plurality of openings of relatively low impedance to vapor flow therethrough and extending orthogonally from a surface in contact with a heat input surface of the evaporator section to an opposing surface (*Abstract*), and is cited for the purpose of disclosing a vapor vent. Corman et al. fail to overcome the deficiencies of Fries described above. In particular, Corman et al. fail to teach, described, or suggest, among other things, “a wick ... comprising a plurality of particles comprising a first species of particle having a first size and a second species of particle having a second size...said first species of particle and said second species of particle are each disposed within said wick in graded homogenous layers” as claimed in claim 34.

In light of the above and for other reasons not discussed herein, withdrawal of the 35 U.S.C. §103(a) rejection of claim 34 is respectfully requested.

On pages 4 and 5 of the Office Action, claims 1, 22, 41, and 42 are rejected under 35 U.S.C. §103(a) as being unpatentable over Fries and/or Corman et al. in view of Yoshizumi et al. (JP 359024538).

Claim 1 calls for:

A capillary structure for a heat transfer device comprising:  
a plurality of particles comprising a first species of particle and a second species of particle, said plurality of particles being joined together by a brazing compound such that fillets of said brazing compound are formed between adjacent ones of said plurality of particles so as to form a network of capillary passageways between said particles; wherein said first species of particle and said second species of particle are each disposed within said capillary structure in homogenous layers.

Claim 22 calls for:

A capillary structure for a heat transfer device comprising:  
a plurality of particles comprising a first species of particle having a first size and a second species of particle having a second size, said plurality of particles being joined together by a brazing compound such that fillets of said brazing compound are formed between adjacent ones of said plurality of particles so as to form a network of capillary passageways between said particles; wherein said first species of particle and said second species of particle are each disposed

within said capillary structure in substantially homogenous layers, wherein a plurality of vapor vents are defined through said capillary structure.

Claim 41 calls for:

A heat pipe comprising:

a sealed and partially evacuated tubular enclosure being sealed at a first end and having an internal surface covered by a brazed wick comprising a plurality of particles comprising a first species of particle and a second species of particle, said first species and said second species of particle being joined together by a brazing compound such that fillets of said brazing compound are formed between adjacent ones of said particles so as to form a network of capillary passageways between said particles;

a base sealingly fixed to a second end of said enclosure so as to form an internal surface within said enclosure wherein said wick is formed on said base including said first species of particles and said second species of particles each disposed within said wick in substantially homogenous layers;

a working fluid disposed within said enclosure; and

at least one fin projecting radially outwardly from an outer surface of said tubular enclosure.

Claim 42 calls for:

A heat pipe comprising:

a sealed and partially evacuated tubular enclosure being sealed at a first end and having an internal surface covered by a brazed wick comprising a plurality of particles comprising a first species of particle and a second species of particle said first species and said second species of particle being joined together so as to form a network of capillary passageways between said particles;

a base sealingly fixed to a second end of said enclosure so as to form an internal surface within said enclosure wherein said wick is formed on said base including said first species of particles and said second species of particles each disposed within said wick in substantially homogenous layers, and further including at least one vapor vent that is defined through a portion of said wick;

a working fluid disposed within said enclosure; and

at least one fin projecting radially outwardly from an outer surface of said tubular enclosure.

In contrast, and as described above, Fries discloses a heat pipe having a wick that comprises a first layer having a small-pore structure and disposed adjacent a vapor space within a pipe, and a second layer having a large-pore structure and disposed adjacent the first layer (*Abstract*). Thus, Fries fails to teach, describe, or suggest, among other things, a heat pipe or a capillary structure for a heat transfer device comprising a plurality of particles comprising a first

species of particle and a second species of particle, wherein the first species of particle and the second species of particle are each disposed within a wick or capillary structure in homogenous layers” as claimed in claims 1, 22, 41, and 42.

Corman et al. disclose a heat pipe with a portion of a wick having a plurality of openings of relatively low impedance to vapor flow therethrough and extending orthogonally from a surface in contact with a heat input surface of the evaporator section to an opposing surface (*Abstract*), and is cited for the purpose of disclosing a vapor vent. Corman et al. fail to overcome the deficiencies of Fries described above. In particular, Corman et al. fail to teach, describe, or suggest, among other things, a plurality of particles comprising a first species of particle and a second species of particle, wherein the first species of particle and the second species of particle are each disposed within said capillary structure or a wick in homogenous layers as claimed in claims 1, 22, 41, and 42.

Yoshizumi et al. disclose a method of manufacturing a heat-pipe including forming a silver adhesion layer of 2-3  $\mu\text{m}$  by silver plating, vapor deposition, or the like onto a surface, and forming a thin silver layer on the surface of microscopic copper spheres (*see pages 2-3 of Yoshizumi et al.*). Yoshizumi et al. is cited for the purpose of disclosing fillets of brazing material compound between adjacent particles, and fails to teach, describe, or suggest, among other things, a plurality of particles comprising a first species of particle and a second species of particle, wherein the first species of particle and the second species of particle are each disposed within said capillary structure or a wick in homogenous layers as claimed in claims 1, 22, 41, and 42. Thus, neither Fries, nor Corman et al, nor Yoshizumi, et al., nor their combined teachings render claims 1, 22, 41, and 42 obvious.

In light of the above and for other reasons not discussed herein, withdrawal of the 35 U.S.C. §103(a) rejection of claims 1, 22, 41, and 42 is respectfully requested.

Dependent Claims

Also on pages 4-5 of the Office Action, claims 2, 6, 8, 17, and 23 are rejected under 35 U.S.C. §103(a) as being unpatentable over Fries and Corman et al. in view of Yoshizumi et al. Claims 2, 6, 8, 17, and 23 are each dependent upon amended claims 1 and 22, respectively, and are allowable based upon claims 1 and 22 and upon other features and elements claimed in claims 2, 6, 8, 17, and 23 but not discussed herein. Withdrawal of the 35 U.S.C. §103(a) rejections of claims 2, 6, 8, 17, and 23 is therefore respectfully requested.

CONCLUSION

In view of the foregoing, it is respectfully submitted that the claims of the present application are in condition for allowance. The Applicants request that the Examiner telephone the attorneys of record in the event a telephone discussion would be helpful in advancing the prosecution of the present application.

Respectfully submitted,



Christopher B. Austin  
Reg. No. 41,592

Michael Best & Friedrich LLP  
100 East Wisconsin Avenue  
Milwaukee, Wisconsin 53202-4108  
(414) 271-6560